567—41.2(455B) Biological maximum contaminant level (MCL), treatment technique (TT), and monitoring requirements.

41.2(1) *Coliform bacteria and E. coli.* The provisions of this subrule include both maximum contaminant level and treatment technique requirements. The provisions of this subrule apply to all public water systems. Failure to comply with the applicable requirements in this subrule is a violation of the national primary drinking water regulations.

a. Maximum contaminant level. A public water system must determine compliance with the MCL for *E. coli* for each month in which the system is required to monitor for total coliforms. A system is in compliance with the MCL for *E. coli* for samples taken under this subrule unless any of the following conditions occur. For purposes of the public notification requirements in 567—42.1(455B), violation of the MCL may pose an acute risk to health.

(1) *E. coli*-positive repeat sample. The system has an *E. coli*-positive repeat sample following a total coliform-positive routine sample.

(2) *E. coli*-positive routine sample. The system has a total coliform-positive repeat sample following an *E. coli*-positive routine sample.

(3) Failure to collect all required repeat samples following *E. coli*-positive routine samples. The system fails to take all required repeat samples following an *E. coli*-positive routine sample.

(4) Failure to test for *E. coli* on any total coliform-positive repeat sample. The system fails to test for *E. coli* when any repeat sample tests positive for total coliform.

b. Analytical methodology.

(1) Sample volume. The standard sample volume required for analysis is 100 mL, regardless of the analytical method used.

(2) Presence/absence required. Only the presence or absence of total coliforms and *E. coli* is required to be determined in any compliance sample; a determination of density is acceptable but is not required.

(3) Holding time and temperature. The time from sample collection to initiation of test medium incubation may not exceed 30 hours. Systems are encouraged but not required to hold samples below 10° C during transit.

(4) Dechlorinating agent required for chlorinated water. If water having a residual chlorine (measured as free, combined, or total chlorine) is to be analyzed, sufficient sodium thiosulfate ($Na_2S_2O_3$) must be added to the sample bottle before sterilization to neutralize any residual chlorine in the water sample. Dechlorination procedures are addressed in Section 9060A.2 of Standard Methods for the Examination of Water and Wastewater (20th and 21st editions).

(5) Systems must conduct total coliform and *E. coli* analyses in accordance with one of the analytical methods in the following table.

Methodology Category	Method[1]	Citation[1]
Total Coliform Bacteria Methods:		
Lactose Fermentation Methods	Standard Total Coliform Fermentation Technique	Standard Methods 9221 B.1, B.2 (20th, 21st, and 22nd ed.)[2, 3] Standard Methods Online 9221 B.1, B.2-99, B-06[2, 3]
	Presence-Absence (P-A) Coliform Test	Standard Methods 9221 D.1, D.2 (20th and 21st ed.)[2, 7] Standard Methods Online 9221 D.1, D.2-99[2, 7]
Membrane Filtration Methods	Standard Total Coliform Membrane Filter Procedure	Standard Methods 9222 B, C (20th and 21st ed.)[2, 4] Standard Methods Online 9222 B-97[2, 4], 9222 C-97[2, 4]
	Membrane Filtration using MI Medium	EPA Method 1604[2]
	m-ColiBlue24 Test[2, 4]	
	Chromocult[2, 4]	

Methodology Category	Method[1]	Citation[1]
Enzyme Substrate Methods	Colilert	Standard Methods 9223 B (20th, 21st and 22nd ed.)[2, 5] Standard Methods Online 9223 B-97, B-04[2, 5]
	Colilert-18	Standard Methods 9223 B (21st and 22nd ed.)[2, 5] Standard Methods Online 9223 B-04[2, 5]
	Colisure	Standard Methods 9223 B (20th, 21st and 22nd ed.)[2, 5, 6] Standard Methods Online 9223 B-97, B-04[2, 5, 6]
	E*Colite Test[2]	
	Readycult Test[2]	
	modified Colitag Test[2]	
	Tecta EC/TC Test[2]	
***Escherichia coli (E. coli)* Methods:**		
Escherichia coli Procedures (following Lactose Fermentation Methods)	EC-MUG Medium	Standard Methods 9221 F.1 (20th, 21st and 22nd ed.)[2] Standard Methods Online 9221 F-06[2]
Escherichia coli Partition Method	EC broth with MUG (EC-MUG)	Standard Methods 9222 G.1*c*(2) (20th and 21st ed.)[2, 8]
	NA-MUG Medium	Standard Methods 9222 G.1*c*(1) (20th and 21st ed.)[2]
Membrane Filtration Methods	Membrane Filtration using MI Medium	EPA Method 1604[2]
	m-ColiBlue24 Test[2, 4]	
	Chromocult[2, 4]	
Enzyme Substrate Methods	Colilert	Standard Methods 9223 B (20th, 21st and 22nd ed.)[2, 5] Standard Methods Online 9223 B-97, B-04[2, 5, 6]
	Colilert-18	Standard Methods 9223 B (21st and 22nd ed.)[2, 5] Standard Methods Online 9223 B-04[2, 5]
	Colisure	Standard Methods 9223 B (20th, 21st and 22nd ed.)[2, 5, 6] Standard Methods Online 9223 B-97, 04[2, 5, 6]
	E*Colite Test[2]	
	Readycult Test[2]	
	modified Colitag Test[2]	
	Tecta EC/TC Test[2]	

[1]The procedures must be done in accordance with the documents listed in 41.2(1)*"a"*(6). For Standard Methods, either the 20th (1998) or 21st (2005) edition may be used. For Standard Methods Online, the year in which each method was approved by the Standard Methods Committee is designated by the last two digits following the hyphen in the method number. The methods listed are the only online versions that may be used. For vendor methods, the date of the method listed in 41.2(1)*"a"*(6) is the date/version of the approved method. The methods listed are the only versions that may be used for compliance with this rule. Laboratories should be careful to use only the approved versions of the methods, as product package inserts may not be the same as the approved versions of the methods.

[2]Incorporated by reference. See 41.2(1)*"a"*(6).

[3]Lactose broth, as commercially available, may be used in lieu of lauryl tryptose broth if the system conducts at least 25 parallel tests between lactose broth and lauryl tryptose broth using the water normally tested and if the findings from this comparison demonstrate that the false-positive rate and the false-negative rate for total coliforms, using lactose broth, is less than 10 percent.

[4]All filtration series must begin with membrane filtration equipment that has been sterilized by autoclaving. Exposure of filtration equipment to UV light is not adequate to ensure sterilization. Subsequent to the initial autoclaving, exposure of the filtration equipment to UV light may be used to sanitize the funnels between filtrations within a filtration series. Alternatively, membrane filtration equipment that is presterilized by the manufacturer (i.e., disposable funnel units) may be used.

[5]Multiple-tube and multi-well enumerative formats for this method are approved for use in presence-absence determination under this subrule.

[6]Colisure results may be read after an incubation time of 24 hours.

[7]A multiple-tube enumerative format, as described in Standard Methods for the Examination of Water and Wastewater 9221, is approved for this method for use in presence-absence determination under this subrule.

[8]The following changes must be made to the EC broth with MUG (EC-MUG) formulation: Potassium dihydrogen phosphate, KH_2PO_4, must be 1.5 g, and 4-methylumbelliferyl-beta-D-glucuronide must be 0.05 g.

(6) Methods incorporated by reference. The standards required in this subrule are incorporated by reference with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR Part 51. All approved material is available for inspection either electronically at www.regulations.gov, in hard copy at the Water Docket, or from the sources indicated below. The Docket ID is EPA-HQ-OW-2008-0878. Hard copies of these documents may be viewed at the Water Docket in the EPA Docket Center, (EPA/DC) EPA West, Room 3334, 1301 Constitution Avenue, NW, Washington, DC. The EPA Docket Center Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202)566-1744, and the telephone number for the Water Docket is (202)566-2426. Copyrighted materials are only available for viewing in hard copy. These documents are also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call (202)741-6030 or go to www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.

1. American Public Health Association, 800 I Street, NW, Washington, DC 20001. Standard Methods for the Examination of Water and Wastewater, 20th edition (1998):

- Standard Methods 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group," B.1, B.2, "Standard Total Coliform Fermentation Technique."
- Standard Methods 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group," D.1, D.2, "Presence-Absence (P-A) Coliform Test."
- Standard Methods 9222, "Membrane Filter Technique for Members of the Coliform Group," B, "Standard Total Coliform Membrane Filter Procedure."
- Standard Methods 9222, "Membrane Filter Technique for Members of the Coliform Group," C, "Delayed-Incubation Total Coliform Procedure."
- Standard Methods 9223, "Enzyme Substrate Coliform Test," B, "Enzyme Substrate Test," Colilert and Colisure.
- Standard Methods 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group," F.1, "*Escherichia coli* Procedure: EC-MUG Medium."
- Standard Methods 9222, "Membrane Filter Technique for Members of the Coliform Group," G.1*c*(2), "*Escherichia coli* Partition Method: EC Broth with MUG (EC-MUG)."
- Standard Methods 9222, "Membrane Filter Technique for Members of the Coliform Group," G.1*c*(1), "*Escherichia coli* Partition Method: NA-MUG Medium."

2. American Public Health Association, 800 I Street, NW, Washington, DC 20001. Standard Methods for the Examination of Water and Wastewater, 21st edition (2005):

- Standard Methods 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group," B.1, B.2, "Standard Total Coliform Fermentation Technique."
- Standard Methods 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group," D.1, D.2, "Presence-Absence (P-A) Coliform Test."
- Standard Methods 9221, "Membrane Filter Technique for Members of the Coliform Group," B, "Standard Total Coliform Membrane Filter Procedure."
- Standard Methods 9222, "Membrane Filter Technique for Members of the Coliform Group," C, "Delayed-Incubation Total Coliform Procedure."
- Standard Methods 9223, "Enzyme Substrate Coliform Test," B, "Enzyme Substrate Test," Colilert and Colisure.
- Standard Methods 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group," F.1, "*Escherichia coli* Procedure: EC-MUG Medium."

- Standard Methods 9222, "Membrane Filter Technique for Members of the Coliform Group," G.1.*c*(2), "*Escherichia coli* Partition Method: EC Broth with MUG (EC-MUG)."
- Standard Methods 9222, "Membrane Filter Technique for Members of the Coliform Group," G.1.*c*(1), "*Escherichia coli* Partition Method: NA-MUG Medium."

3. American Public Health Association, 800 I Street, NW, Washington, DC 20001. "Standard Methods Online" available at www.standardmethods.org:

- Standard Methods Online 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group" (1999), B.1, B.2-99, B-06, "Standard Total Coliform Fermentation Technique."
- Standard Methods Online 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group" (1999), D.1, D.2-99, "Presence-Absence (P-A) Coliform Test."
- Standard Methods Online 9222, "Membrane Filter Technique for Members of the Coliform Group" (1997), B-97, "Standard Total Coliform Membrane Filter Procedure."
- Standard Methods Online 9222, "Membrane Filter Technique for Members of the Coliform Group" (1997), C-97, "Delayed-Incubation Total Coliform Procedure."
- Standard Methods Online 9223, "Enzyme Substrate Coliform Test" (1997), B-97, "Enzyme Substrate Test," Colilert and Colisure.

4. Charm Sciences, Inc., 659 Andover Street, Lawrence, MA 01843-1032; telephone (800)343-2170: E*Colite—"Charm E*Colite Presence/Absence Test for Detection and Identification of Coliform Bacteria and *Escherichia coli* in Drinking Water," January 9, 1998.

5. CPI International, Inc., 5580 Skylane Blvd., Santa Rosa, CA 95403; telephone (800)878-7654: modified Colitag, ATP D05-0035—"Modified Colitag Test Method for the Simultaneous Detection of *E. coli* and other Total Coliforms in Water," August 28, 2009.

6. EMD Millipore (a division of Merck KGaA, Darmstadt, Germany), 290 Concord Road, Billerica, MA 01821; telephone (800)645-5476:

- Chromocult—"Chromocult Coliform Agar Presence/Absence Membrane Filter Test Method for Detection and Identification of Coliform Bacteria and *Escherichia coli* for Finished Waters," November 2000, Version 1.0.
- Readycult—"Readycult Coliforms 100 Presence/Absence Test for Detection and Identification of Coliform Bacteria and *Escherichia coli* in Finished Waters," January 2007, Version 1.1.

7. EPA's Water Resource Center (MC-4100T), 1200 Pennsylvania Avenue, NW, Washington, DC 20460; telephone (202)566-1729: EPA Method 1604, EPA 821-R-02-024—"EPA Method 1604: Total Coliforms and *Escherichia coli* in Water by Membrane Filtration Using a Simultaneous Detection Technique (MI Medium)," September 2002, www.nemi.gov.

8. Hach Company, P.O. Box 389, Loveland, CO 80539; telephone (800)604-3493: m-ColiBlue24—"Membrane Filtration Method m-ColiBlue24 Broth," Revision 2, August 17, 1999.

9. American Public Health Association, 800 I Street, NW, Washington, DC 20001. Standard Methods for the Examination of Water and Wastewater, 22nd edition (2012):

- Standard Methods 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group," B.1, B.2, "Standard Total Coliform Fermentation Technique."
- Standard Methods 9223, "Enzyme Substrate Coliform Test," B, "Enzyme Substrate Test," Colilert and Colisure.
- Standard Methods 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group," F.1, "*Escherichia coli* Procedure: EC-MUG Medium."

10. Veolia Water Solutions and Technologies, Suite 4697, Biosciences Complex, 116 Barrie Street, Kingston, Ontario, Canada K7L 3N6: Tecta EC/TC. "Presence/Absence Method for Simultaneous Detection of Total Coliforms and *Escherichia coli* in Drinking Water," April 2014.

(7) Laboratory certification. Systems must have all compliance samples required under this subrule analyzed by a laboratory certified by the department in accordance with 567—Chapter 83 to analyze drinking water samples. The laboratory used by the system must be certified for each method and associated contaminant used for compliance monitoring analyses under this subrule.

c. Sampling plan.

(1) Written sampling plan required. Systems must collect total coliform samples according to the written sampling plan.

1. Systems must develop a written sampling plan that identifies sample locations and a sample collection schedule that are representative of water throughout the distribution system. Major elements of the plan shall include, but not be limited to, the following:

- Map of the distribution system served by the system;
- List of routine compliance sample locations for each sample period;
- List of repeat compliance sample locations for each routine compliance sample location;
- Any other sample locations necessary to meet the requirements of this subrule;
- Sample collection schedule;
- Proper sampling technique instructions;
- Log of samples taken; and
- For groundwater systems subject to 567—41.7(455B), triggered source water monitoring plan.

2. The system shall review the sampling plan every two years and update it as needed and shall retain the sampling plan on file at the facility. The plan must be made available to the department upon request and for review during sanitary surveys and must be revised by the system at the direction of the department.

3. Monitoring under this subrule may take place at a customer's premises, dedicated sampling station, or other designated compliance sampling location.

(2) Sampling schedule. Systems must collect routine samples at regular time intervals throughout the month. Systems that use only groundwater and serve 4,900 or fewer people, or regional water systems that use only groundwater and serve less than 121 miles of pipe, may collect all required routine samples on a single day if the samples are taken from different sites.

(3) Minimum number of required routine samples. Systems must take at least the minimum number of required routine samples even if the system has had an *E. coli* MCL violation or has exceeded the coliform treatment technique triggers in 41.2(1)*"l."* Such samples must be designated as "routine" when submitted to the laboratory.

(4) Additional compliance monitoring samples. A system may conduct more compliance monitoring than is required to investigate potential problems in the distribution system and may use monitoring as a tool to assist in uncovering problems. A system may take more than the minimum number of required routine samples and must include the results when calculating whether the coliform treatment technique trigger in 41.2(1)*"l"*(1)"1" and "2" has been exceeded only if the samples are taken in accordance with the existing sampling plan and are representative of water throughout the distribution system. Such samples must be designated as "routine" when submitted to the laboratory.

(5) Repeat samples. Systems must identify repeat monitoring locations in the sampling plan. Repeat samples must be analyzed at the same laboratory as the corresponding original routine sample(s), unless written approval for use of a different laboratory is granted by the department. The system must collect at least one repeat sample from the sampling tap where the original routine total coliform-positive sample was taken, at least one repeat sample at a tap within five service connections upstream of the original sample location, and at least one repeat sample at a tap within five service connections downstream of the original sample location. Such samples must be designated as "repeat" when submitted to the laboratory.

1. If the sampling location of a total coliform-positive sample is at or within one service connection from the end of the distribution system, the system must still take all required repeat samples. However, the department may allow an alternative sampling location in lieu of one of the upstream or downstream sampling locations.

2. A groundwater system with two or more wells that is required to conduct triggered source water monitoring under subrule 41.7(3) must collect groundwater source sample(s) in addition to the required repeat samples.

3. A groundwater system with a single well that is required to conduct triggered source water monitoring may, with written department approval, collect one of its required repeat samples at the triggered source water sample monitoring location. The system must demonstrate to the department's

satisfaction that the sampling plan remains representative of water quality in the distribution system. If approved, the sample result may be used to meet the requirements of subrule 41.7(3) and this subrule. If a repeat sample taken at the triggered source water monitoring location is *E. coli*-positive, the system has violated the *E. coli* MCL, and must also comply with the requirements for additional source water samples under 41.7(3)*"a"*(3).

4. The department may review, revise, and approve, as appropriate, repeat sampling proposed by the system under 41.2(1)*"c"*(5). The system must demonstrate that the sampling plan remains representative of the water quality in the distribution system.

(6) Special purpose samples. Special purpose samples, such as those taken to determine whether disinfection practices are sufficient following pipe placement, replacement, or repair, must not be used to determine whether the coliform treatment technique trigger has been exceeded. Repeat samples are not considered special purpose samples and must be used to determine whether the coliform treatment technique trigger has been exceeded. Such samples must be designated as "special" when submitted to the laboratory and cannot be used for compliance.

(7) Residual disinfectant measurement. Any system adding a chemical disinfectant to the water must meet the requirements specified in 567—subparagraph 42.4(3)*"b"*(1). The minimum required residual disinfectant measurements are as follows, unless otherwise directed by the department in writing:

1. Groundwater systems. A system that uses only groundwater and adds a chemical disinfectant or provides water that contains a disinfectant must measure and record the free and total chlorine residual disinfectant concentration at least at the same points in the distribution system and at the same time as routine and repeat total coliform bacteria samples are collected, as specified in 41.2(1)*"e"* through 41.2(1)*"j."* The system shall report the residual disinfectant concentration to the laboratory with the bacteria sample and comply with the applicable reporting requirements of 567—subrule 42.4(3).

2. Surface water and influenced groundwater systems.

- Any surface water or IGW PWS must meet the requirements for minimum residual disinfectant entering the distribution system pursuant to 567—paragraph 43.5(4)*"b"*(2)"1"; and
- A system that uses surface water or IGW must comply with the requirements specified in 567—paragraph 43.5(4)*"b"*(2)"2" for daily distribution system residual disinfectant monitoring. The system must measure and record the free and total chlorine residual disinfectant concentration at least at the same points in the distribution system and at the same time as routine and repeat total coliform bacteria samples are collected, as specified in 41.2(1)*"e"* through 41.2(1)*"j."* The residual disinfectant measurements required as a part of this subrule may be used to satisfy the requirement in 567—paragraph 43.5(4)*"b"*(2)"2" on the day(s) when a routine or repeat total coliform bacteria sample(s) is collected, in lieu of separate samples. The system shall report the residual disinfectant concentration to the laboratory with the bacteria sample and comply with the applicable reporting requirements of 567—subrule 42.4(3).

d. Invalidation of total coliform samples. A total coliform-positive sample invalidated under this paragraph does not count toward meeting the minimum monitoring requirements of this subrule.

(1) The department may invalidate a total coliform-positive sample only if the following conditions are met:

1. The laboratory establishes that improper sample analysis caused the total coliform-positive result.

2. The department, on the basis of the results of the required repeat samples, determines that the total coliform-positive sample resulted from a domestic or other non-distribution system plumbing problem. "Domestic or other non-distribution system plumbing problem" means a coliform contamination problem in a public water system with more than one service connection that is limited to the specific service connection from which the coliform-positive sample was taken. The department cannot invalidate a sample on the basis of repeat sample results unless all repeat samples collected at the same tap as the original total coliform-positive sample are also total coliform-positive and all repeat samples collected at a location other than the original tap are total coliform-negative. The department cannot invalidate a total coliform-positive sample on the basis of repeat samples if all the repeat samples are total coliform-negative or if the system has only one service connection.

3. The department has substantial grounds to believe that the total coliform-positive result is due to a circumstance or condition that does not reflect water quality in the distribution system. The system must still collect all repeat samples required under 41.2(1)*"j"* and use them to determine whether a coliform treatment technique trigger in 41.2(1)*"l"* has been exceeded.

The decision and supporting rationale for invalidating a total coliform-positive sample under 41.2(1)*"d"*(1) must be documented in writing, and approved and signed by the supervisor of the water supply operations section or water supply engineering section and the department official who recommended the decision. The department must make this document available to EPA and the public. The written documentation must state the specific cause of the total coliform-positive sample and what action the system has taken, or will take, to correct this problem. The department may not invalidate a total coliform-positive sample solely on the grounds that all repeat samples are total coliform-negative or because of poor sampling technique.

(2) Laboratory invalidation. A laboratory must invalidate a total coliform sample (unless total coliforms are detected, in which case the sample is valid) if the sample produces a turbid culture in the absence of gas production using an analytical method where gas formation is examined (e.g., the multiple-tube fermentation technique), produces a turbid culture in the absence of an acid reaction in the presence-absence (P-A) coliform test, or exhibits confluent growth or produces colonies too numerous to count with an analytical method using a membrane filter (e.g., membrane filter technique). If a laboratory invalidates a sample because of such interference, the system must collect another sample from the same location as that of the original sample within 24 hours of being notified of the interference problem and must have the sample analyzed for the presence of total coliforms. The system must continue to resample within 24 hours and have the samples analyzed until a valid result is obtained. The department may waive the 24-hour time limit on a case-by-case basis.

e. Routine monitoring for specific groundwater noncommunity water systems serving 1,000 or fewer people. This paragraph applies to noncommunity water systems using only groundwater (not IGW) as a source and serving 1,000 or fewer people. Groundwater noncommunity water systems that serve schools, preschools, and child care facilities, and all public water systems owned or managed by state agencies, such as parks and rest areas, must monitor at the same frequency as a like-sized community water system, in accordance with 41.2(1)*"f,"* 41.2(1)*"g,"* or 41.2(1)*"h."*

(1) General. Following any total coliform-positive sample taken under 41.2(1)*"e,"* systems must comply with the repeat monitoring requirements and *E. coli* analytical requirements in 41.2(1)*"j."* Once all monitoring required by 41.2(1)*"e"* and 41.2(1)*"j"* for a calendar month has been completed, systems must determine whether any coliform treatment technique triggers specified in 41.2(1)*"l"* have been exceeded. If any trigger has been exceeded, systems must complete assessments as required by 41.2(1)*"l."*

(2) Monitoring frequency for total coliforms. Systems must monitor each calendar quarter that the system provides water to the public, with the following exceptions:

1. A system on quarterly monitoring that experiences any of the following events must begin monthly monitoring in the month following the event. The system must continue on monthly monitoring until the system meets the requirements for returning to quarterly monitoring.

- The system has an *E. coli* MCL violation.
- The system triggers one Level 2 assessment under the provisions of 41.2(1)*"l"* in a rolling 12-month period.
- The system triggers two Level 1 assessments under the provisions of 41.2(1)*"l"* in a rolling 12-month period.
- The system has a coliform treatment technique violation.
- The system has two coliform monitoring violations in a rolling 12-month period.
- The system has one monitoring coliform violation and one Level 1 assessment under the provisions of 41.2(1)*"l"* in a rolling 12-month period.

2. A system on monthly monitoring for reasons other than those identified in 41.2(1)*"e"*(2)"1" is not considered to be on increased monitoring for the purposes of 41.2(1).

3. Seasonal systems must sample each month in which they are in operation. All seasonal systems must also demonstrate completion of a department-approved start-up procedure before serving water to the public, which includes a requirement for a coliform-negative start-up sample.

(3) Evaluation of sampling frequency during a sanitary survey. During each sanitary survey, the department must evaluate the status of the system including the distribution system, to determine whether the system is on an appropriate monitoring schedule. The department may modify the system's monitoring schedule, as necessary, or may allow the system to stay on its existing monitoring schedule, consistent with the provisions of 41.2(1)*"e."*

(4) Requirements for returning from monthly to quarterly sampling frequency for nonseasonal noncommunity systems. The department may reduce the monitoring frequency for a nonseasonal noncommunity system on monthly monitoring triggered under 41.2(1)*"e"*(2)"1" to quarterly monitoring if the system meets the following criteria. For the purposes of 41.2(1)*"e"*(4), "protected water source" means the well meets separation distances from sources of microbial contamination pursuant to 567—subrule 43.3(7), Table A; or the system has 4-log virus inactivation treatment that is approved by the department and is in continuous usage.

1. Within the previous 12 months, the system must have a completed sanitary survey or voluntary Level 2 assessment, be free of sanitary defects, and have a protected water source;

2. The system must have a clean compliance history for a minimum of the previous 12 months; and

3. The department must review the approved sampling plan, which must designate the time period(s) for monitoring based on site-specific considerations (e.g., during periods of highest demand or highest vulnerability to contamination). The system must collect compliance samples during these time periods.

(5) Additional routine monitoring for systems on quarterly sampling in the month following a total coliform-positive routine sample. Systems collecting samples on a quarterly frequency must conduct additional routine monitoring the month following one or more total coliform-positive samples (with or without a Level 1 treatment technique trigger). Systems must collect at least three routine samples during the next month. Systems may either collect samples at regular time intervals throughout the month or may collect all required routine samples on a single day if samples are taken from different sites. Systems must use the results of additional routine samples in coliform treatment technique trigger calculations under 41.2(1)*"l."*

f. Routine monitoring for groundwater community water systems serving 1,000 or fewer people. This paragraph applies to community water systems using only groundwater (not IGW) as a source and serving 1,000 or fewer people.

(1) General. Following any total coliform-positive sample taken under 41.2(1)*"f,"* systems must comply with the repeat monitoring requirements and *E. coli* analytical requirements in 41.2(1)*"j."* Once all monitoring required by 41.2(1)*"f"* and 41.2(1)*"j"* for a calendar month has been completed, systems must determine whether any coliform treatment technique triggers specified in 41.2(1)*"l"* have been exceeded. If any trigger has been exceeded, systems must complete assessments as required by 41.2(1)*"l."*

(2) Monitoring frequency for total coliforms. The routine monitoring frequency for total coliforms is one sample per month.

g. Routine monitoring requirements for SW/IGW public water systems serving 1,000 or fewer people. This paragraph applies to all public water supply systems serving 1,000 or fewer people that use surface water/influenced groundwater sources, including consecutive systems.

(1) General. Following any total coliform-positive sample taken under 41.2(1)*"g,"* systems must comply with the repeat monitoring requirements and *E. coli* analytical requirements in 41.2(1)*"j."* Once all monitoring required by 41.2(1)*"g"* and 41.2(1)*"j"* for a calendar month has been completed, systems must determine whether any coliform treatment technique triggers specified in 41.2(1)*"l"* have been exceeded. If any trigger has been exceeded, systems must complete assessments as required by 41.2(1)*"l."*

(2) Monitoring frequency for total coliforms. The routine monitoring frequency for total coliforms is one sample per month. Systems may not reduce monitoring frequency.

(3) Seasonal systems must sample each month in which they are in operation, and the monitoring frequency cannot be reduced. All seasonal systems must also demonstrate completion of a department-approved start-up procedure before serving water to the public, which includes a requirement for a coliform-negative start-up sample.

h. Routine monitoring requirements for public water systems serving more than 1,000 people. The provisions of this paragraph apply to all public water systems serving more than 1,000 people except regional water systems. The requirements for regional water systems are listed in 41.2(1)*"i."*

(1) General. Following any total coliform-positive sample taken under 41.2(1)*"h,"* systems must comply with the repeat monitoring requirements and *E. coli* analytical requirements in 41.2(1)*"j."* Once all monitoring required by 41.2(1)*"h"* and 41.2(1)*"l"* for a calendar month has been completed, systems must determine whether any coliform treatment technique triggers specified in 41.2(1)*"l"* have been exceeded. If any trigger has been exceeded, systems must complete assessments as required by 41.2(1)*"l."*

(2) Monitoring frequency for total coliforms. The routine monitoring frequency for total coliforms is based upon the population served by the system, as follows:

Population Served	Minimum Number of Routine Samples per Month
1,001 to 2,500	2
2,501 to 3,300	3
3,301 to 4,100	4
4,101 to 4,900	5
4,901 to 5,800	6
5,801 to 6,700	7
6,701 to 7,600	8
7,601 to 8,500	9
8,501 to 12,900	10
12,901 to 17,200	15
17,201 to 21,500	20
21,501 to 25,000	25
25,001 to 33,000	30
33,001 to 41,000	40
41,001 to 50,000	50
50,001 to 59,000	60
59,001 to 70,000	70
70,001 to 83,000	80
83,001 to 96,000	90
96,001 to 130,000	100
130,001 to 220,000	120
220,001 to 320,000	150
320,001 to 450,000	180
450,001 to 600,000	210
600,001 to 780,000	240
780,001 to 970,000	270
970,001 to 1,230,000	300

(3) Seasonal systems must sample each month in which they are in operation, and the monitoring frequency cannot be reduced. All seasonal systems must also demonstrate completion of a department-approved start-up procedure before serving water to the public, which includes a requirement for a coliform-negative start-up sample.

(4) Reduced monitoring. Community systems may not reduce the number of required routine samples.

(5) Increased monitoring. If the department, on the basis of a sanitary survey or monitoring results history, determines that some greater frequency of monitoring is more appropriate, that frequency shall be the frequency required under these rules. The increased frequency shall be confirmed or changed on the basis of subsequent surveys.

i. Routine monitoring requirements for regional public water systems. The provisions of 41.2(1)*"i"* apply to all regional water systems. The supplier of water for a regional water system as defined in 567—40.2(455B) shall sample for coliform bacteria at a frequency based upon the miles of pipe in its distribution system.

(1) General. Following any total coliform-positive sample taken under 41.2(1)*"i,"* systems must comply with the repeat monitoring requirements and *E. coli* analytical requirements in 41.2(1)*"j."* Once all monitoring required by 41.2(1)*"i"* and 41.2(1)*"j"* for a calendar month has been completed, systems must determine whether any coliform treatment technique triggers specified in 41.2(1)*"l"* have been exceeded. If any trigger has been exceeded, systems must complete assessments as required by 41.2(1)*"l."*

(2) Monitoring frequency for total coliforms. The routine monitoring frequency for total coliforms is based upon the miles of pipe in the system's distribution system, as indicated in the following chart. In no case shall the sampling frequency for a regional water system be less than as set forth in 41.2(1)*"h"* based upon the population equivalent served. The following chart represents sampling frequency per miles of pipe in the distribution system and is determined by calculating one-half the square root of the miles of pipe.

Miles of Pipe	Minimum Number of Routine Samples per Month
0 – 9	1
10 – 25	2
26 – 49	3
50 – 81	4
82 – 121	5
122 – 169	6
170 – 225	7
226 – 289	8
290 – 361	9
362 – 441	10
442 – 529	11
530 – 625	12
626 – 729	13
730 – 841	14
842 – 961	15
962 – 1,089	16
1,090 – 1,225	17
1,226 – 1,364	18

Miles of Pipe	Minimum Number of Routine Samples per Month
1,365 – 1,521	19
1,522 – 1,681	20
1,682 – 1,849	21
1,850 – 2,025	22
2,026 – 2,209	23
2,210 – 2,401	24
2,402 – 2,601	25
2,602 – 2,809	26
2,810 – 3,025	27
3,026 – 3,249	28
3,250 – 3,481	29
3,482 – 3,721	30
3,722 – 3,969	31
3,970 – 4,225	32
4,226 – 4,489	33
4,490 – 4,671	34
4,672 – 5,041	35
5,042 – 5,329	36
5,330 – 5,625	37
5,626 – 5,929	38
5,930 – 6,241	39
6,242 – 6,561	40
6,562 and greater	41

(3) Reduced monitoring. Regional water systems may not reduce the number of required routine samples.

(4) Increased monitoring. If the department, on the basis of a sanitary survey or monitoring results history, determines that some greater frequency of monitoring is more appropriate, that frequency shall be the frequency required under these rules. The increased frequency shall be confirmed or changed on the basis of subsequent surveys.

j. Repeat monitoring. If a routine sample taken under 41.2(1)*"e"* through 41.2(1)*"i"* is total coliform-positive, the system must collect a set of repeat samples. The department cannot waive the requirement for a system to collect repeat samples.

(1) The system must collect no fewer than three repeat samples for each total coliform-positive routine sample found.

(2) The system must collect the repeat samples within 24 hours of being notified of the positive routine sample result. The department may extend the 24-hour limit on a case-by-case basis if the system has a logistical problem in collecting the repeat samples within 24 hours that is beyond its control. In the case of an extension, the department must specify how much time the system has to collect the repeat samples.

(3) The system must collect all repeat samples on the same day, except that the department may allow a system with a single service connection to collect the required set of repeat samples over a three-day period. "System with a single service connection" means a system which supplies drinking water to consumers through a single service line.

(4) The system must collect an additional set of repeat samples in the manner specified in 41.2(1)*"j"*(1) to (3) if one or more repeat samples in the current set of repeat samples is total coliform-positive. The system must collect the additional set of repeat samples within 24 hours of being notified of the positive result, unless the department extends the limit as provided in 41.2(1)*"j"*(2). The system must continue to collect additional sets of repeat samples until either total coliforms are not detected in one complete set of repeat samples or the system determines that a coliform treatment technique trigger specified in 41.2(1)*"l"* has been exceeded as a result of a total coliform-positive repeat sample and notifies the department. If a trigger identified in 41.2(1)*"l"* is exceeded as a result of a total coliform-positive routine sample, systems are required to conduct only one round of repeat monitoring for each total coliform-positive routine sample.

(5) Results of all routine and repeat samples taken under 41.2(1)*"e"* through 41.2(1)*"i"* that are not invalidated by the department must be used to determine whether a coliform treatment technique trigger specified in 41.2(1)*"l"* has been exceeded.

k. E. coli testing requirements.

(1) If any routine or repeat sample is total coliform-positive, the system must analyze that total coliform-positive culture medium to determine the presence of *E. coli*. If *E. coli* are present, the system must notify the department by the end of the same day when the system is notified of the test result. If the notification is outside of the department's routine office hours, the system shall call the department's Environmental Emergency Reporting Hotline at (515)725-8694.

(2) The department has the discretion to allow a system, on a case-by-case basis, to forgo *E. coli* testing on a total coliform-positive sample if that system assumes that the total coliform-positive sample is *E. coli*-positive. Accordingly, the system must notify the department as specified in 41.2(1)*"k"*(1), and the provisions of 41.2(1)*"a"* apply.

l. Coliform treatment technique triggers. Systems must conduct assessments in accordance with 41.2(1)*"m"* after exceeding any treatment technique trigger.

(1) Level 1 treatment technique triggers.

1. For systems taking 40 or more samples per month, the system exceeds 5.0 percent total coliform-positive samples for the month.

2. For systems taking fewer than 40 samples per month, the system has two or more total coliform-positive samples in the same month.

3. The system fails to take every required repeat sample after any single total coliform-positive sample.

(2) Level 2 treatment technique triggers.

1. An *E. coli* MCL violation, as specified in 41.2(1)*"p"*(1).

2. A second Level 1 trigger as defined in 41.2(1)*"l"*(1) within a rolling 12-month period, unless the department has determined a likely reason that the samples that caused the first Level 1 treatment technique trigger were total coliform-positive and has established that the system has corrected the problem.

m. Assessment requirements. Systems must ensure that Level 1 and 2 assessments are conducted in order to identify the possible presence of sanitary defects and defects in distribution system coliform monitoring practices. Level 1 assessments may be conducted by the system owner or operator. Level 2 assessments must be conducted by the department with the assistance of the system owner or operator.

(1) General. When conducting assessments, systems must ensure that the assessor evaluates minimum elements that include review and identification of inadequacies in sample sites; sampling protocol; sample processing; atypical events that could affect distributed water quality or indicate that distributed water quality was impaired; changes in distribution system maintenance and operation that could affect distributed water quality (including water storage); source and treatment considerations that bear on distributed water quality, where appropriate (e.g., small groundwater systems); and existing water quality monitoring data. The system must conduct the assessment consistent with any department directives that tailor specific assessment elements with respect to the size and type of the system, and the size type, and characteristics of the distribution system.

(2) Level 1 assessment. A system must conduct a Level 1 assessment consistent with the department requirements if the system exceeds one of the treatment technique triggers in 41.2(1)*"l"*(1).

1. The system must complete the Level 1 assessment as soon as practical after any trigger in 41.2(1)*"l"*(1). In the completed assessment form, the system must describe sanitary defects detected, corrective actions completed, and a proposed timetable for any corrective actions not already completed. The system may also note on the assessment form that no sanitary defects were identified. The system must submit the completed Level 1 assessment form to the department within 30 days after the system learns that it has exceeded a trigger.

2. If the department reviews the completed Level 1 assessment and determines that the assessment is not sufficient (including any proposed timetable for any corrective actions not already completed), the department must consult with the system. If the department requires revisions after consultation, the system must submit a revised assessment form to the department on an agreed-upon schedule not to exceed 30 days from the date of the consultation.

3. Upon completion and submission of the assessment form by the system, the department must determine if the system has identified the likely cause for the Level 1 trigger and, if so, establish that the system has corrected the problem or has included a schedule acceptable to the department for correction of the problem.

(3) Level 2 assessment. A system must ensure that a Level 2 assessment is conducted if the system exceeds one of the treatment technique triggers in 41.2(1)*"l"*(2). The system must comply with any expedited actions or additional actions required by the department in the case of an *E. coli* MCL violation.

1. The system must ensure that a Level 2 assessment is completed by the department as soon as practical after any trigger in 41.2(1)*"l"*(2). The system must submit a completed Level 2 assessment form to the department within 30 days after the system learns that it has exceeded a trigger. The assessment form must contain a description of the sanitary defects detected, corrective actions completed, and a proposed timetable for any corrective actions not already completed. It may also be noted on the assessment form that no sanitary defects were identified.

2. If the department reviews the completed Level 2 assessment and determines that the assessment is not sufficient (including any proposed timetable for any corrective actions not already completed), the department must consult with the system. If the department requires revisions after consultation, the system must submit a revised assessment form to the department on an agreed-upon schedule not to exceed 30 days.

3. Upon completion and submission of the assessment form by the system, the department must determine if the system has identified the likely cause for the Level 2 trigger and determine whether the system has corrected the problem or has included a schedule acceptable to the department for correction of the problem.

(4) Corrective actions. A system must correct sanitary defects found through either a Level 1 or 2 assessment conducted under 41.2(1)*"l."* For corrections not completed by the time of submission of the assessment form, the system must complete the corrective action(s) in compliance with a timetable approved by the department in consultation with the system. The system must notify the department when each scheduled corrective action is completed.

(5) Consultation. At any time during the assessment or corrective actions phase, either the water system or the department may request a consultation with the other party to determine the appropriate actions to be taken. The system may consult with the department on all relevant information that may impact on its ability to comply with a requirement of this subrule, including the method of accomplishment, an appropriate time frame, and other relevant information.

n. Reporting requirements.

(1) *E. coli*.

1. The system must notify the department by the end of the same day when the system learns of an *E. coli*-positive violation. If the notification is outside of the department's routine office hours, the system shall call the department's Environmental Emergency Reporting Hotline at (515)725-8694.

2. The system must notify the department by the end of the same day when the system learns of the *E. coli*-positive routine sample. If the notification is outside of the department's routine office hours, the system shall call the department's Environmental Emergency Reporting Hotline at (515)725-8694.

(2) A system that has violated the treatment technique for coliforms in 41.2(1)*"l"* must report the violation to the department no later than the end of the next business day after it learns of the violation, and must notify the public in accordance with rule 567—42.1(455B).

(3) A system required to conduct an assessment under the provisions of 41.2(1)*"l"* must submit the assessment report within 30 days. The system must notify the department in accordance with 41.2(1)*"m"*(4) when each scheduled corrective action is completed for any corrections that were not completed by the time of submission of the assessment form.

(4) A system that has failed to comply with a coliform monitoring requirement must report the monitoring violation to the department within 10 days after the system discovers the violation, and must notify the public in accordance with rule 567—42.1(455B).

(5) A seasonal system must certify, prior to serving water to the public, that it has complied with the department-approved start-up procedure.

o. Record-keeping requirements. Additional record-keeping requirements are listed in 567—paragraph 42.5(1)*"j."*

p. Violations.

(1) *E. coli* MCL violation. A system is in violation of the MCL for *E. coli* when any of the following occurs, and must conduct public notice in accordance with rule 567—42.1(455B):

1. The system has an *E. coli*-positive repeat sample following a total coliform-positive routine sample.

2. The system has a total coliform-positive repeat sample following an *E. coli*-positive routine sample.

3. The system fails to take all required repeat samples following an *E. coli*-positive routine sample.

4. The system fails to test for *E. coli* when any repeat sample tests positive for total coliform.

(2) Treatment technique violation. A system is in violation of a treatment technique trigger when any of the following occurs, and must conduct public notice in accordance with rule 567—42.1(455B):

1. A system exceeds a treatment technique trigger specified in 41.2(1)*"l"* and then fails to conduct the required assessment within the time frame specified in 41.2(1)*"m."*

2. A system exceeds a treatment technique trigger specified in 41.2(1)*"l"* and then fails to conduct the required corrective actions within the time frame specified in 41.2(1)*"m"*(4).

3. A seasonal system fails to complete a department-approved start-up procedure prior to serving water to the public, including collection of a finished water sample that tests total coliform-negative.

(3) Monitoring violation. A system is in violation of monitoring requirements when any of the following occurs, and must conduct public notice in accordance with rule 567—42.1(455B):

1. Failure to take every required routine or additional routine sample in a compliance period.

2. Failure to analyze for *E. coli* following a total coliform-positive routine sample.

(4) Reporting violation. A system is in violation of reporting requirements when any of the following occurs, and must conduct public notice in accordance with rule 567—42.1(455B):

1. Failure to submit a monitoring report after a system properly conducts monitoring in a timely manner.

2. Failure to submit a completed assessment form after a system properly conducts an assessment in a timely manner.

3. Failure to notify the department following an *E. coli*-positive sample as required by 41.2(1)*"k"*(1) in a timely manner.

4. Failure to submit the certification of completion of department-approved start-up procedure by a seasonal system.

q. Best available technology (BAT). The U.S. Environmental Protection Agency (EPA) identifies, and the department has adopted, the following as the best technology, treatment techniques, or other means available for all systems in achieving compliance with the maximum contaminant level for *E. coli* in 41.2(1)*"a."* The following is also identified as affordable technology, treatment techniques, or

other means available to systems serving 10,000 or fewer people for achieving compliance with the *E. coli* maximum contaminant level.

(1) Well protection. Protection of wells from fecal contamination by appropriate placement and construction.

(2) Disinfectant residual. Maintenance of a disinfectant residual throughout the distribution system.

(3) Distribution system maintenance. Proper maintenance of the distribution system including appropriate pipe replacement and repair procedures, main flushing programs, proper operation and maintenance of storage tanks and reservoirs, cross-connection control, and continual maintenance of a minimum positive water pressure of 20 psi in all parts of the distribution system at all times.

(4) Filtration or disinfection. Filtration and disinfection of surface water or groundwater under the direct influence of surface water in accordance with 567—43.5(455B), 567—43.9(455B), and 567—43.10(455B), or disinfection of groundwater in accordance with rule 567—41.7(455B) using strong oxidants such as, but not limited to, chlorine, chlorine dioxide, or ozone.

(5) Wellhead protection program. For groundwater systems, compliance with the requirements of the department's wellhead protection program.

41.2(2) *Giardia.* Reserved.

41.2(3) *Heterotrophic plate count bacteria (HPC).*

a. Applicability. All public water systems that use a surface water source or source under the direct influence of surface water must provide treatment consisting of disinfection, as specified in 567—subrule 43.5(2), and filtration treatment which complies with 567—subrule 43.5(3). The heterotrophic plate count is an alternate method to demonstrate a detectable disinfectant residual in accordance with 567—paragraph 43.5(2)*"d."*

b. Maximum contaminant levels. Reserved.

c. Monitoring requirements. Reserved.

d. BAT. Reserved.

e. Analytical methodology. Public water systems shall conduct heterotrophic plate count bacteria analysis in accordance with 567—subrule 43.5(2) and the following analytical method. Measurements for heterotrophic plate count bacteria must be conducted by a laboratory certified by the department to do such analysis, when heterotrophic plate count bacteria are being measured in lieu of a detectable residual disinfectant pursuant to 567—paragraph 43.5(2)*"d."* In addition, the time from sample collection to initiation of analysis may not exceed eight hours, and the systems must hold the samples below 10 degrees Celsius during transit to the laboratory.

(1) Method. The heterotrophic plate count shall be performed in accordance with one of the following methods:

1. Method 9215B Pour Plate Method, Standard Methods for the Examination of Water and Wastewater, 18th edition, 1992, 19th edition, 1995, 20th edition, 1998, 21st edition, 2005, and 22nd edition, 2012. The cited method in any of these editions may be used. Standard Methods Online method 9215 B-04 may be used.

2. SimPlate Method, "IDEXX SimPlate TM HPC Test Method for Heterotrophs in Water," November 2000, IDEXX Laboratories, Inc., One IDEXX Drive, Westbrook, ME 04092, telephone (800)321-0207.

(2) Reporting. The public water system shall report the results of heterotrophic plate count in accordance with 567—subparagraph 42.4(3)*"c"*(2).

41.2(4) *Macroscopic organisms and algae.*

a. Applicability. These rules apply to both community and noncommunity public water supply systems using surface water or groundwater under direct influence of surface water as defined by 567—subrule 43.5(1).

b. Maximum contaminant levels (MCLs) for macroscopic organisms and algae. Finished water shall be free of any macroscopic organisms such as plankton, worms, or cysts. The finished water algal cell count shall not exceed 500 organisms per milliliter or 10 percent of the total cells found in the raw water, whichever is greater.

c. Monitoring requirements. Reserved.

d. *BAT.* Reserved.

e. *Analytical methodology.* Measurement of the algal cells shall be in accordance with Method 10200F: Phytoplankton Counting Techniques, Standard Methods for the Examination of Water and Wastewater, 18th edition, pp. 10-13 to 10-16. Such measurement shall be required only when the department determines on the basis of complaints or otherwise that excessive algal cells may be present.
[**ARC 9915B**, IAB 12/14/11, effective 1/18/12; **ARC 3735C**, IAB 4/11/18, effective 5/16/18]